

SECTION 1

STANDARD SERVICE PROCEDURE

REVISION:- 7

DATE:- 14.03.2001

AUTHORISATION:-

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CONTROLLED DOCUMENT

SECTION 1

SERVICING

1. Introduction

The standard service of a Tec 4 Vaporizer shall consist of the following:

Disassembly of components as required.
Thorough cleaning.
Inspection for damage and wear.
Renewal of Wicks, Seals and damaged or worn components as required.
Lubrication.
Tactile Tests.
Checks of the delivered concentration under closely defined conditions and re-calibration as necessary.

Unless otherwise stated, the procedures which follow are applicable to all Tec 4 vaporizers.

At each stage of testing, the operator shall record the test results on Service Record AEQF-10.7.1/3 (filled-in by hand) and on the Test Certificate generated by the laser refractometer and laptop computer.

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2 SERVICE PROCEDURES

2.1 Draining and Drying Out

2.1.1 Method 1

2.1.1.1 Draining

- a) Drain all the free liquid from the vaporizer until only a very small amount of liquid can be seen in the level tube. Note. Draining can be assisted by carefully tilting the vaporizer slightly forwards.

2.1.1.2 Drying-Out

- a) Mount the vaporizer on the test stand and turn the dial to its maximum setting.
- b) Pass a flow of 5 litres/minute air or oxygen through the vaporizer for at least one hour until the wicks have dried out. Exhaust to suitable a gas scavenging system.

Alternatively:

- a) Block the outlet of the vaporizer, turn the dial to its maximum setting and connect the vaporizer drain to a vacuum system (between 10 and 30 litres/minute negative flow) for one hour until the vaporizer is dry.

2.1.2 Method 2

Agent Recovery Condensers

2.1.1.1 Draining

- a) Connect the vaporizer to the vacuum system by inserting drug specific adaptor into the drain port of the keyed filler assembly and clamping it in position with the clamp screw.
- b) Open the drain screw and set the dial to its maximum mark.
- c) To ensure that all liquid is drained from the vaporizer, *tilt the vaporizer forward* slightly until liquid can no longer be seen flowing into the glass flask.

2.1.2 Drying Out

- a) Ensure that the Condenser is switched 'OFF'.
- b) Open the drain valve, and drain off all agent into the appropriately labelled measuring cylinder. Record the quantity of anaesthetic agent recovered on the Condenser Record Form AEQF-10.6.1/1.
- c) Transfer the agent into the appropriately labelled brown Winchester bottle for future purity check.(Refer to TEST EQUIPMENT MANUAL Section 11). Store the Winchester bottle in the designated quarantine area of the drug cupboard.

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ENFLURANE CONDENSER ONLY

Close the valve on the outlet to the Condenser and open the drain valve.
Turn on the drying-out pump at the time-switch to force any remaining water out of the system.
Turn off the drying-out pump, close the drain valve, and open the outlet valve.
NOTE: In order to speed up the Condenser thawing-out process, the heater switch may be set in the red-light position.

ISOFLURANE CONDENSER ONLY

Close the valve on the outlet to the condenser and open the drain valve. Detach the pipe "T" connection on the Condenser inlet, and blow through the Condenser using an air-line gun to force out any remaining water from the system.
Open the outlet valve and re-fit the "T" piece.

- d) Switch on the Condenser by turning the switch to the cooling position, (the green lamp will be illuminated) and allow a period of 45 minutes to elapse in order to permit the correct operating temperature to be achieved.
- e) During drying-out monitor the Condenser pressure gauge. An increase in pressure indicates that ice is causing a restriction to the gas flow, and that action must be taken to restore the Condenser's optimum operating condition.
- f) If the specified pressure is exceeded, inform the Service/Test Supervisor, who will take the required action.
- g) Record the quantity of dried-out vaporizers on AEQF-10.6.1/1

THEN:-

- h) Blank off the inlet port with a plastic plug.
- i) Connect the vaporizer to the evacuation system
- j) Turn the dial to the maximum calibration mark and allow the vaporizers to dry out as follows:

| | |
|------------------------|-----------------|
| Halothane | 40 minutes Max. |
| Enflurane / Isoflurane | 30 minutes Max |

2.2 MAX TEST

See Section 3

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2.3 INSPECTION/CHECK

With the exception of the Serial Number Label, located on the rear face of the Interlock Block, and the vaporizer type label, on the front face of the Interlock Block, carefully remove all other self adhesive labels and adhesive residue from the vaporizer using a cloth moistened with Eilecsol FD or similar cleaning agent. Visually examine the vaporizer for signs of external damage. Where necessary, renew damaged or worn parts during the service. Ensure that the Locking Lever operates positively and that the vaporizer locks satisfactorily onto the Selectatec manifold.

2.4 DIAL ASSEMBLY (Figure 1, Page 8)

- a) Remove the self adhesive Dial Cover Label from the Dial.
- b) Loosen the three cheese-head screws (M3) which secure the Dial and remove the dial Assembly.
- c) Inspect the Clicker Plungers and Springs and also the locking catch mechanism. Renew any parts which are damaged or worn.

2.5 STOP CONTROL (Figure 2, Page 8)

- a) Check the nylon Stop Control for damage and wear and if necessary replace.

NOTE: If the stop control has to be replaced, the position of the edge of the stop at the maximum dial setting may have to be adjusted by cutting or filing the stop so that the dial can reach the maximum graduation on the dial.

2.6 REMOVING/REPLACING A ROTARY (Figure 3, Page 9 and Figures 4 & 5, Page 10)

- a) Remove the Locking Lever screw (M3), the Locking Lever and the Spindle Bush. Peel-off the self adhesive Label from the interlock Block to expose the heads of the hexagon socket head screws (M4). Remove the two Pozi head screws and Top Cover Plate. Unscrew completely the two Pozi head screws and lift out the Pivot Arm/Platform Assembly.

It may be necessary to lever out these assemblies but care must be taken not to damage the black anodizing of the Interlock Block.

Carefully remove the Woodruff Key and put to one side for later use.

Note. There are two designs of Rotary Valve in use. The earlier one uses a separate Woodruff Key and the later one has an integral key.

Unscrew and remove the three M3 clamp screws and Clamp Tabs.

Unscrew the four M5 and the two M4 screws that secure the Interlock Block.

Lift off the Interlock Block, leaving the Rotary Valve, Washers and Compression Spring in place.

Remove the Pivot Cam and Retaining Ring from the Block, lifting over the Spirol Pins. Remove and discard the black rubber Distributor Seal from the bore of the Interlock Block.

Note. If it is necessary to fit a new Serial Plate, the Interlock Block should be drilled at this point.

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- b) Carefully lift the Rotary Valve off the Sump Cover and remove and place to one side the Thrust Washer(Thick), Spring and Thrust Washer(Thin).

NOTE: The Rotary Valve and Sump Cover are very important precision components and great care must be taken not to damage them when they are being worked on or handled.

- c) Inspect and clean the Rotary Valve and Sump Cover checking for damage.
Clean the Rotary Valve by wiping with a soft cloth moistened with Elecsol FD, taking particular care not to damage the lower face, then polish with a clean, dry cloth. NOTE: The Rotary Valve must not be soaked in Elecsol FD. Any marks or dirt on the surface of the Valve, which are not easily removed by wiping, should be removed by gently rubbing with 'Duraglit' Silver Polish Wadding and then wiped with a soft cloth moistened with Elecsol FD. Finally, it should be polished with a clean, dry cloth.

Materials of a more abrasive nature **must not be used.**

- d) Thoroughly clean the Sump Cover with a soft cloth moistened with Elecsol FD taking care not to scratch or damage the main sealing face. Then polish with a clean dry cloth.
- e) Before fitting the Rotary Valve, write the Valve Pressure Reading, if available, on the Service Record.
- f) Very carefully place the Rotary Valve on the Sump Cover with the key or keyway positioned to the right when viewed from the front of the vaporizer.
- g) Inspect the thinner Thrust Washer and also the thicker Thrust Washer and replace as necessary i.e. if damaged or worn.
- h) Place the thinner Thrust Washer over the stem of the Valve, followed by the Spring and then the thicker Thrust Washer.
- i) Take a new Distributor 'U' Seal, lubricate with 'Fomblin' UT18 grease, fit to the special fitting sleeve and place the sleeve over the valve stem.
- j) Check that the PTFE O-Ring is fitted to the Interlock Block then position the Block over the fitting sleeve with the pointer to the front.
- k) Carefully press downwards on the Interlock Block and hold it in place whilst fitting and fully tightening the six (Four M5 and two M4) retaining screws.

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- l) Ensure that there is sufficient Fomblin UT18 grease on the Slip Ring and replace. Grease the Pivot Cam as required with Fomblin UT18 grease and then fit over the Rotary Valve spindle into the Interlock Block. Ensure that the retaining Ring is adequately lubricated with Fomblin UT18 grease and fit into the Interlock Block. Secure the Retaining Ring with the three M3 screws and Clamp Tabs, carefully and evenly tightening down in position.
Lin-up keyways in Cam and Rotary Valve then fit the Woodruff Key.
- m) Ensure that there is sufficient Fomblin UT18 grease on the Platform and Pivot Arm assemblies and re-fit the Interlock assembly.
Secure the assemblies with two M4 screws, tightening down in position but ensuring that there is minimum clearance between the Pivot Bearings and Pivot Arm.
- n) Check that Spring is in position then re-fit Stop Release Button. Check that Clicker Plungers and Springs are in position and re-fit the Dial Assembly, securing with three M3 screws.
- o) Install the Top Cover Plate, securing with two M4 screws. Install the Lock/Unlock Knob Bush on the Locking Lever Spindle.
Install the Lock/Unlock Knob and secure with one M3 screw.
Note that the Lock/Unlock Label may be fitted after the Final Test at the Final Inspection stage.



Figure 1 Dial Assembly

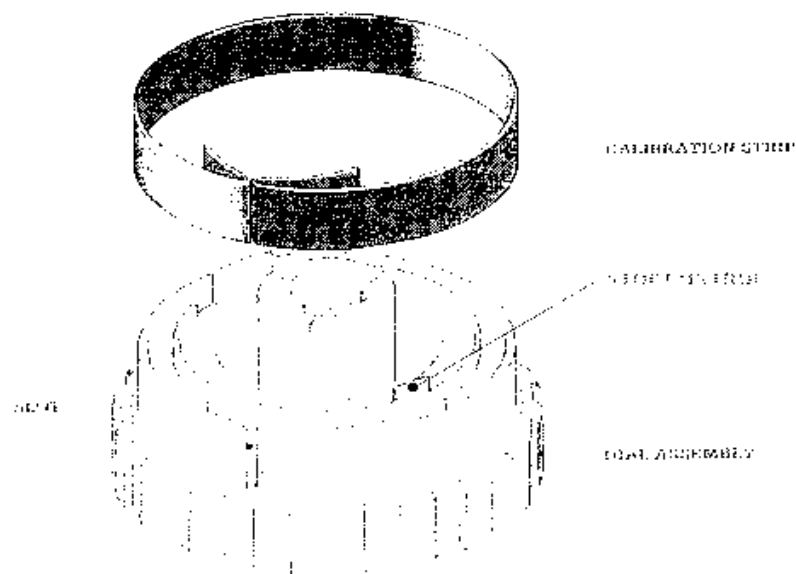


Figure 2 Dial and Stop Control

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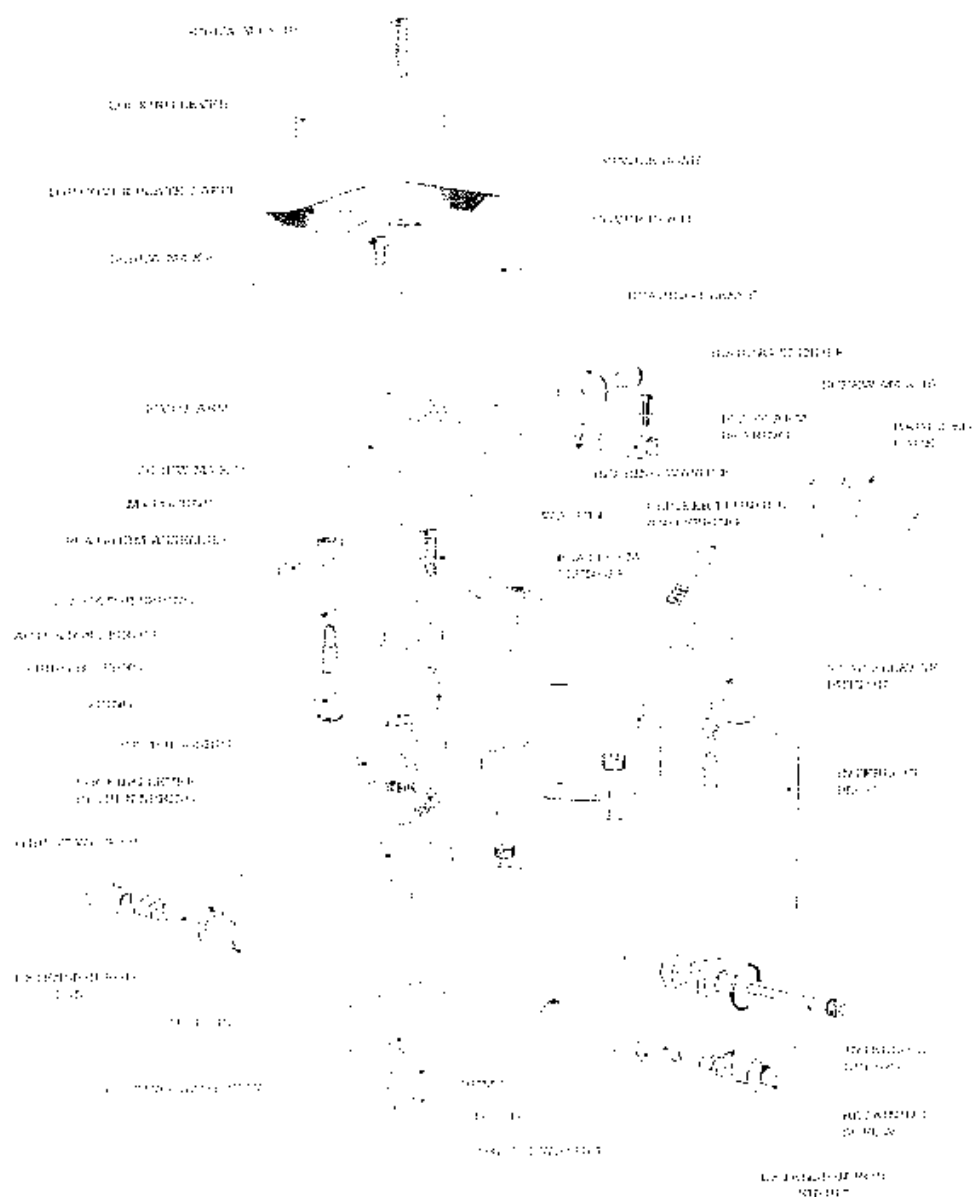


Figure 3 Mechanism

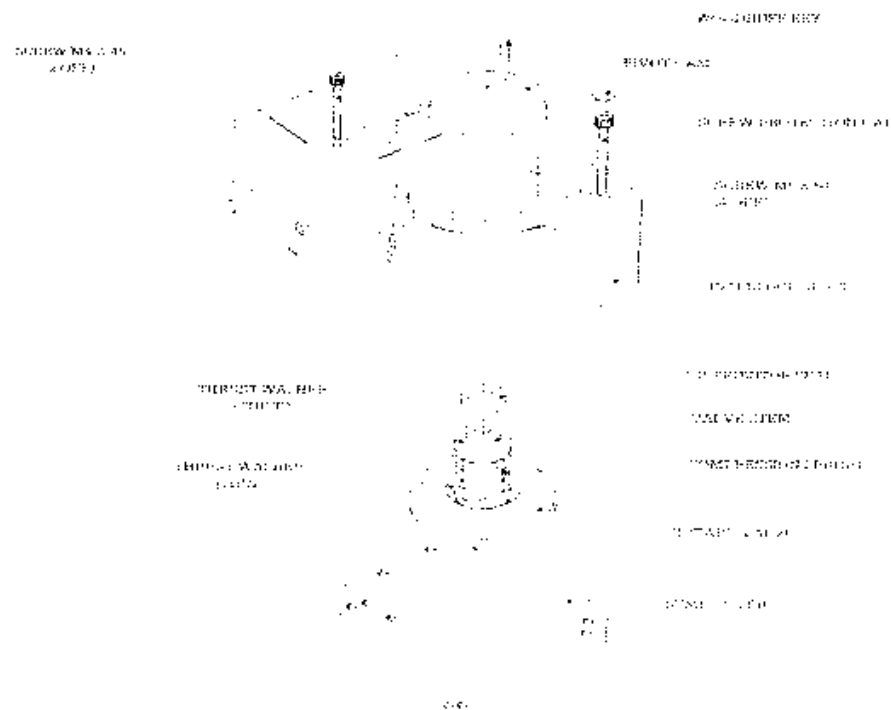


Figure 4 Rotary Valve

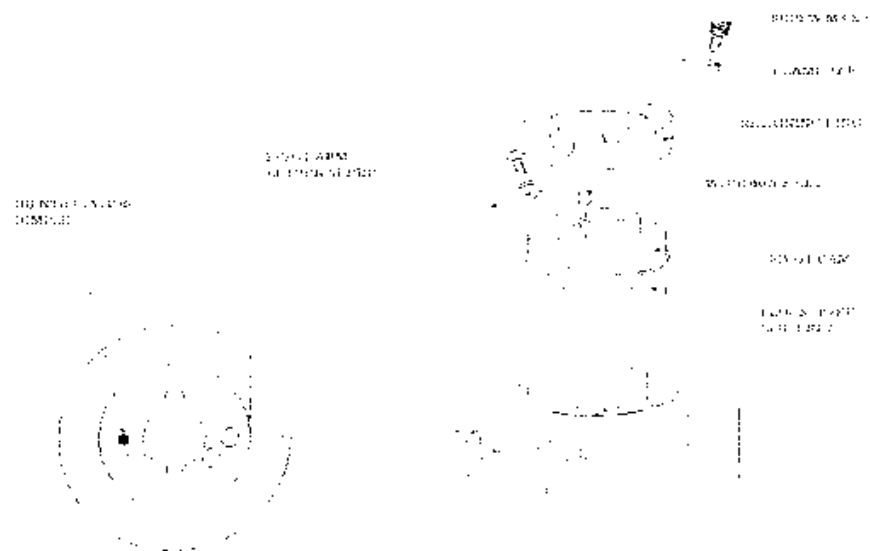


Figure 5 Pivot Cam

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2.7 SUMP ASSEMBLY (Figure 6, Page 13)

NOTE. The vaporizer shall have been drained, dried-out and Max. tested prior to the commencement of this operation.

- a) Remove the self-adhesive Keyed Filler label and unscrew the two M3 screws which retain the filler. If a keyed filler is fitted, care must be taken to ensure that the Filler Ball is not misplaced.
Remove the Filler Assembly and place to one side.
- b) Invert the vaporizer. Remove the four M5 Pozi screws and remove the Outer Cover Base and Heat Pad then lift off the Outer Cover. Place all components to one side for subsequent use.
- c) Cut and remove the Tesa tape to release the Support Plate. Discard the old Tesa Tape.
- d) Unscrew and remove the four Sump Studs and Washers.
Lift off the Sump Assembly with O-Ring. Lift off the Outer Wick Assembly.
Renew the Outer Wick, securing with cotton twine.

2.8 SUMP AND WICKS (Figure 6, Page 13 and Figure 7, Page 14)

2.8.1 Disassembly

- a) Remove the self-adhesive label from the Filler.
- b) Unscrew the two M4 x 35 Socket Cap Screws which secure the Filler Body Assembly to the Sump, remove the Filler Body and the two PTFE seals.

Note: On the Keyed Filler, a 4 mm Nylon Ball is located between the Filler Body and the Sump. When removing the Filler Body, take care not to lose the Ball.
- c) Slacken the three M4 x 6 Hexagon Socket Set Screws which are used to lift the Heat Pad up to the Sump Base.
- d) Unscrew and remove the four M5 x 16 Pozi Pan Head Screws in the Outlet Cover Base and remove the Base and the Heat Pad.
- e) Slide off the Outer Cover.
- f) Remove the Support Plate (if fitted) which is secured to the Sump Studs by adhesive tape. Check that the two Sump Studs at the rear of the unit are of the 'waisted' type. If not, dispose of them and fit the latest type during re-assembly.
- g) Remove and dispose of the Wicks.
 - i) The Outer Wick is attached with thread to the Spiral Support. The Inner Wick is attached with thread to the Inner Wick Support Assembly.
 - ii) Unscrew the two M3 x 5 Pozidrive Screws and remove the Non-Spill Cup. The Non-Spill Cup Wick is attached with thread.

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- h) Remove the four M4 x 10 Cheese Head Screws and remove the Inner Wick Support Assembly complete with Thermostat Cover Assembly. Clean the external surfaces with Elecsol FD or similar cleaning agent.
- i) Note: This next procedure only needs to be carried out if the vaporizer has not been serviced in the past three years.
 - i) Inspect the Thermostat for signs of corrosion and damage.
 - ii) Clean the Thermostat by blowing through with clean compressed air at 210 kPa (30 psi) maximum.
 - iii) Check the Thermostat restriction as detailed in Section XX.
 - iv) Fit a new O-Ring to the Sump Cover face.
 - v) Refit the Thermostat and secure with two M5 x 16 Screws and spring Washers. Ensure that the screws are fully tightened.
- j) Fit three new O-Rings to the Inner Wick Support Assembly, then refit the Assembly.

2.8.2 Assembly

- a) Fit the Inner Wick onto the Inner Wick Support Assembly, ensuring that the cut-out holes are aligned with the holes in the rivets. Secure with cotton thread.
- b) Lay the Non-Spill Cup Wick across the Cup and secure with cotton thread. Fit the Non-Spill Cup into the Baffle and secure with two M3 x 5 Pozi-Drive Screws.
- c) Fit the Outer Wick onto the Wick Support and secure with cotton thread.
- d) Fit the Outer Wick Support over the Inner wick Assembly.

Note: This may be made easier by first wrapping a thin film of plastic, for example Mylar, around the Inner Wick Assembly to form a sleeve, then sliding the the Spiral Wick Assembly over the sleeve onto the Support and then withdrawing the sleeve. A paper sleeve may be used instead of plastic but care must be taken to ensure that the paper does not tear when the paper is withdrawn leaving paper sandwiched between the Wick and the Spiral.

2.8.3 Sump Cleaning

Clean the inside of the Sump using Elecsol FD or a similar a cleaning agent .

2.8.4 Final

Fit a Locking washer to each Hexagon Stud as illustrated (see Figure XX).
Fit a new O-Ring to the Sump Assembly. Attach and secure the Sump Assembly to the Sump Cover using the four Hexagonal Studs, ensuring that no strands of wick lie across the O-Ring located between the Sump Cover and the Sump.

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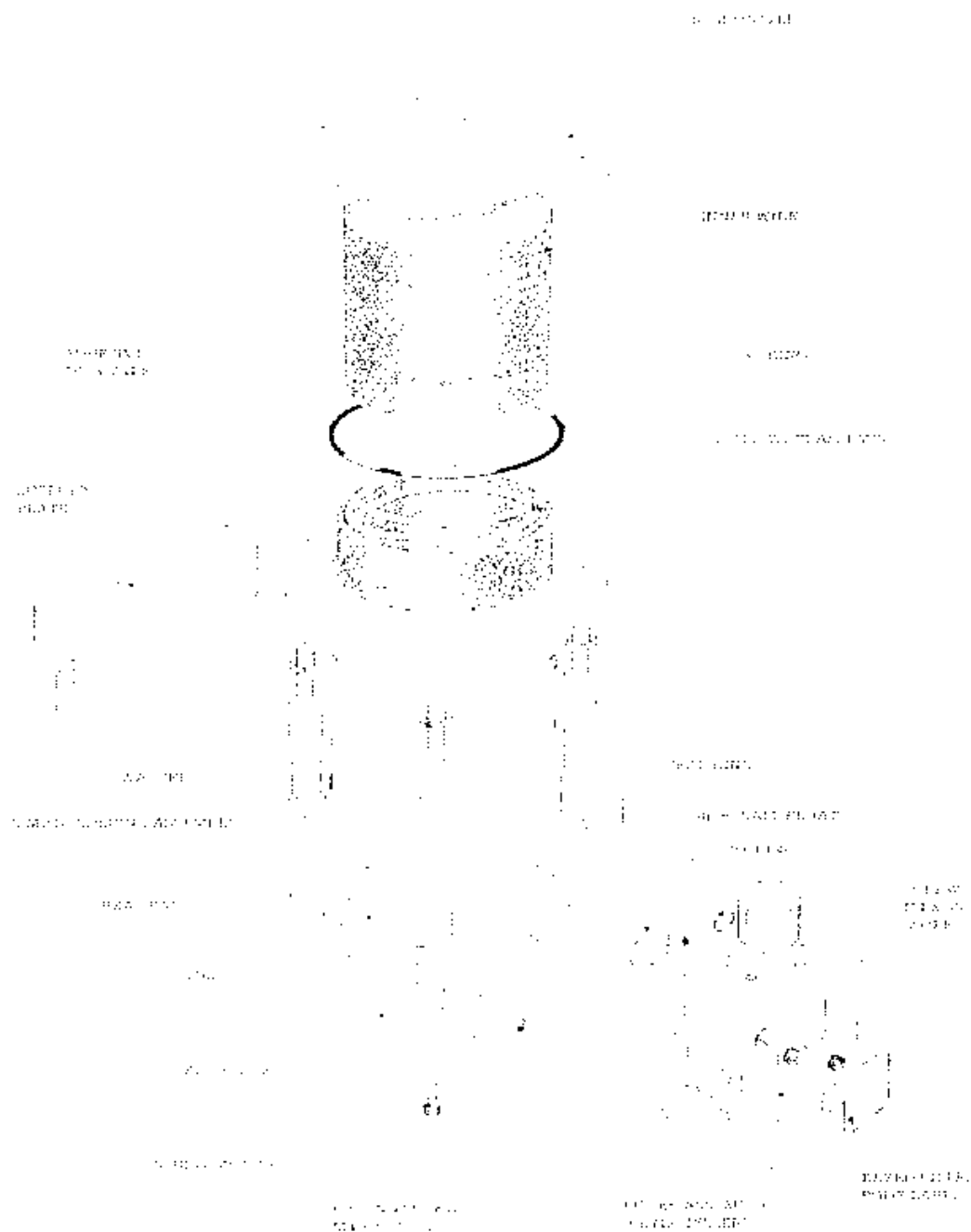
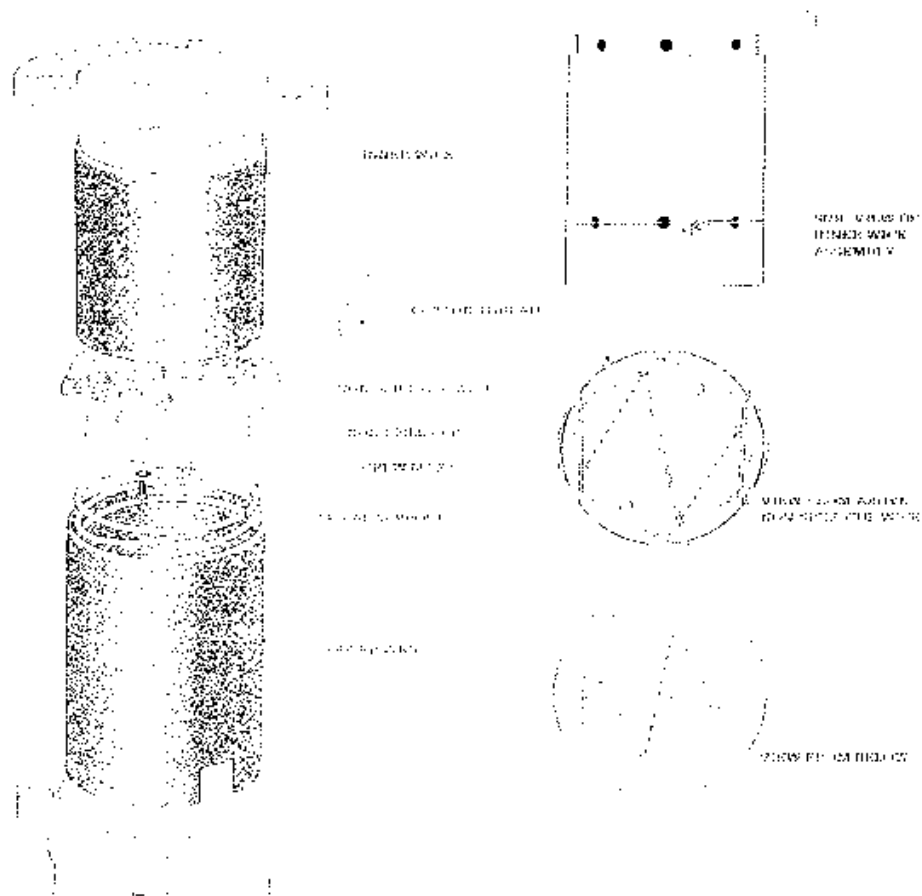


Figure 6 Sump Assembly



NOTE. The knot must be outside of the Inner Wick and in a position where the transfer holes are not obstructed. It must also be of a size which does not restrict fitting of the Spiral Wick Assembly.

Figure 7 Wick Renewal

2.9 THERMOSTAT

N.B. This procedure needs only to be performed if the thermostat is found to be in need of adjustment during calibration.

- a) Unscrew the four M4 slotted head screws which secure the Inner Wick Assembly and lift off the assembly together with the three O-Rings. Place to one side for subsequent use.
- b) Obtain a replacement Thermostat of the correct type and record the number of the new thermostat on the test sheet. Staple the thermostat test record to the vaporizer test sheet. Secure the thermostat to the Sump Cover using the two M5 Pozi screws and washers.
- c) Secure the Inner Wick Assembly to the Sump Cover using the four M4 slotted head screws, ensuring that the three O-Rings are in place and that the Wick is correctly orientated.
- d) Invert the vaporizer.
Wrap greaseproof paper round the Inner Wick Assembly and slide the Spiral Wick Support into position over the Inner Wick, ensuring that the paper has not become torn and that the Inner Wick is not crumpled into the spiral.
Note that the leg of the Spiral is positioned at the bottom of the Sump.
- e) Fit the Sump Assembly over the Wick Assembly ensuring that the Sump O-Ring is in place. Secure the Sump to the Sump Cover with the four Sump Studs.
- f) Secure the Support Plate in position on the Sump Studs with Tesa Tape adhering to the sides of the Sump.
- g) Fit the Outer Cover over the Sump Studs.
Position the Heat Pad on the base of the Sump Assembly. Fit the Outer Cover Base into position on the Outer Cover and secure to the Sump Studs with the four M5 Pozi Pan Head screws.
Secure the Heat Pad to the Sump with the three M4 Grub screws in the Outer Cover Base.

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2.10 FILLER ASSEMBLIES

2.10.1 Keyed Filler Assembly (Figure 8, Page 17)

- a) Inspect the Level Tube. If it is an earlier type, which incorporates a single black band, remove it and fit the later type which has two black bands and two triangles.
- b) When fitting the new Level Tube, fit two new Seals and ensure that the black marked bands and triangles are towards the front face of the filler and that both are in the bottom half of the opening in the Block.
- c) Fit a new O-Ring to the Level Tube Plug. It is necessary to stretch the O-Ring over the thread and then to compress it into the groove.
- d) Unscrew and remove the three M2.5 x 6 Screws which secure the Spool Valve Cam. This operation is easier if the Knob is turned fully counter-clockwise to open the Valve.
- e) Remove the Spool Valve from the Filler Body. Fit three new seals on the Spool Valve using a 2 mm tommy-bar to unscrew the Piston End.
- f) Remove and dispose of the Filler Valve Seal, as illustrated. Apply a jet of clean, dry, compressed air to the ports at the rear of the Filler Body to remove any foreign matter.
- g) Fit a new Valve Seal as illustrated and then carefully refit the Spool Valve into the Filler Body.

2.10.2 Screw Cap Filler Assembly (Figure 9, Page 17)

- a) Inspect the Level Tube. If it is an earlier type, which incorporates a single black band, remove it and fit the later type which has two black bands and two triangles.
- b) When fitting the new Level Tube, fit two new Seals and ensure that the black marked bands and triangles are towards the front face of the filler and that both are in the bottom half of the opening in the Block.
- c) Fit a new O-Ring to the Level Tube Plug. It is necessary to stretch the O-Ring over the thread and then to compress it into the groove.
- d) Unscrew and remove the Filler Plug and the Drain Valve Spindle Assembly.
- e) Apply a jet of clean, dry, compressed air to the ports at the rear of the Filler Body to remove any foreign matter.
- f) Fit a new Seal Ring to the Filler Plug and fit the Filler Plug into the Filler Body.

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Figure 8 Keyed Filler Assembly

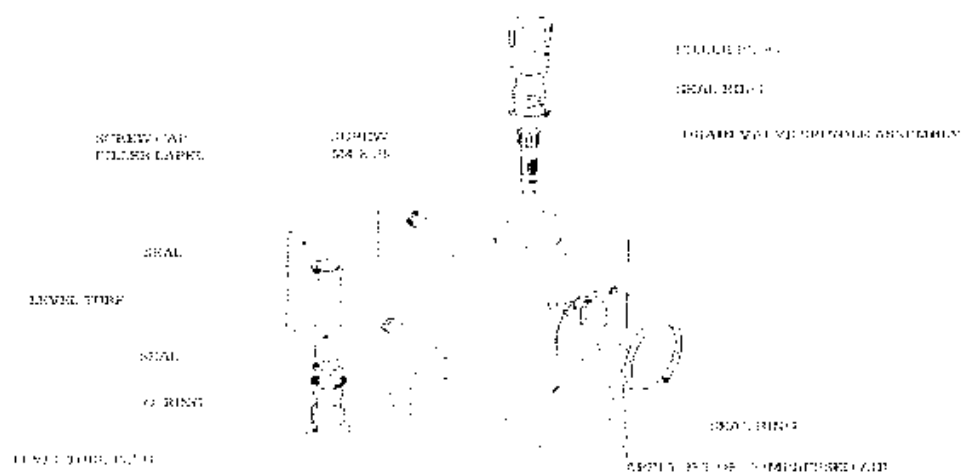


Figure 9 Screw Cap Filler Assembly

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2.11 **FINAL ASSEMBLY**

- a) Fit the Support Plate and secure with adhesive tape. Fit the Outer Cover over the Sump Assembly.
 - b) Fit the Heat Pad and Cover Base and secure to the Hexagon Studs with four M5 x 10 Pozi-Drive Screws. Ensure that the Cover base does not interfere with the Filler Body. If it does, fit the latest type with cut-outs.
 - c) Screw in and tighten the three M4 x 6 Socket Set Screws to lift the Heat Pad up to the Sump Base. Ensure that the Pad is in firm contact with the Base.
 - d) Fit and secure the Filler Assembly to the Sump using new seals.
On the Keyed Filler only, check that the 4 mm Ball is in position.
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A E SERVICES

SECTION 2

LEAK TEST

REVISION: 2

DATE: 14.03.01

AUTHORISATION: 

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SECTION 2

MK.4 VAPORIZER LEAK TEST

VAPORIZER SHOULD CONTAIN NO LIQUID AGENT FOR LEAK TEST AT 'ON'

- 1) Connect Vaporizer into Leak Test circuit (Figure 1).
- 2) Turn the vaporizer on and set the dial to 3%
- 3) Open the line adjustment valve to pressurize the circuit to 200 to 220 mm Hg and allow the pressure reading to stabilize. Note the pressure reading.
- 4) Start the timer and after 30 seconds check the pressure drop.
The maximum allowable pressure drop in 30 seconds is 4 mm Hg.
- 5) If the pressure drop is outside the accepted tolerance, return the vaporizer to the service bench, locate the source of the leak using a suitable brush and leak test fluid, rectify as necessary and repeat the leak test.
- 6) Upon completion of a satisfactory leak test, record the pressure drop on the appropriate Service Record together with the date and relevant signature.
- 7) Disconnect the vaporizer from the Test Circuit.

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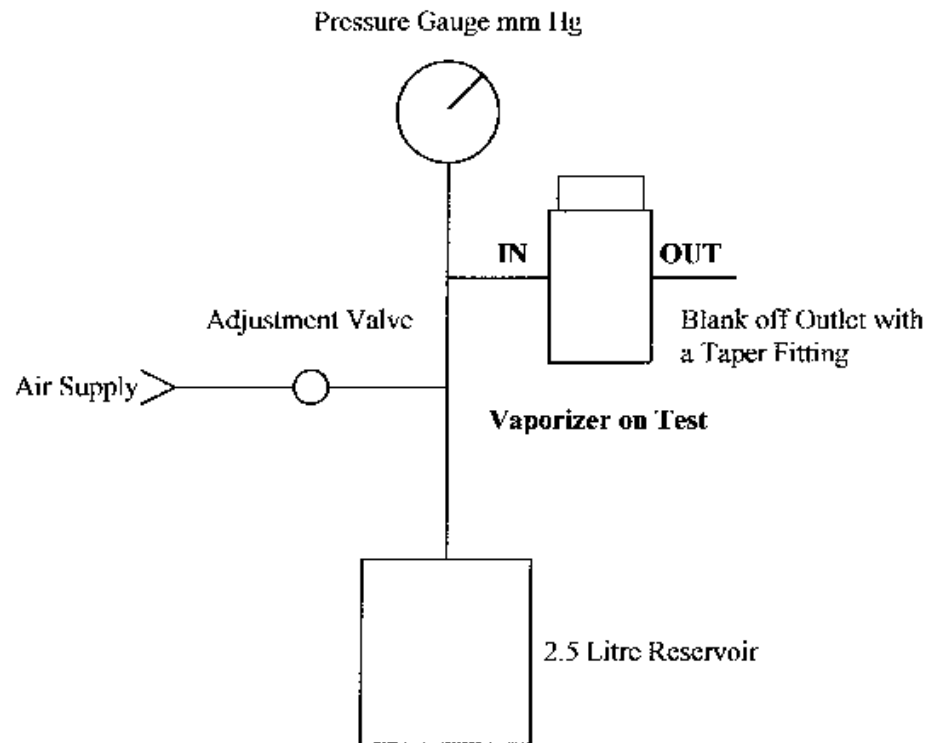


FIGURE 1
LEAK TEST CIRCUIT

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SECTION 3

MAX. TEST

REVISION:- 2

DATE:01.05.95

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SECTION 3

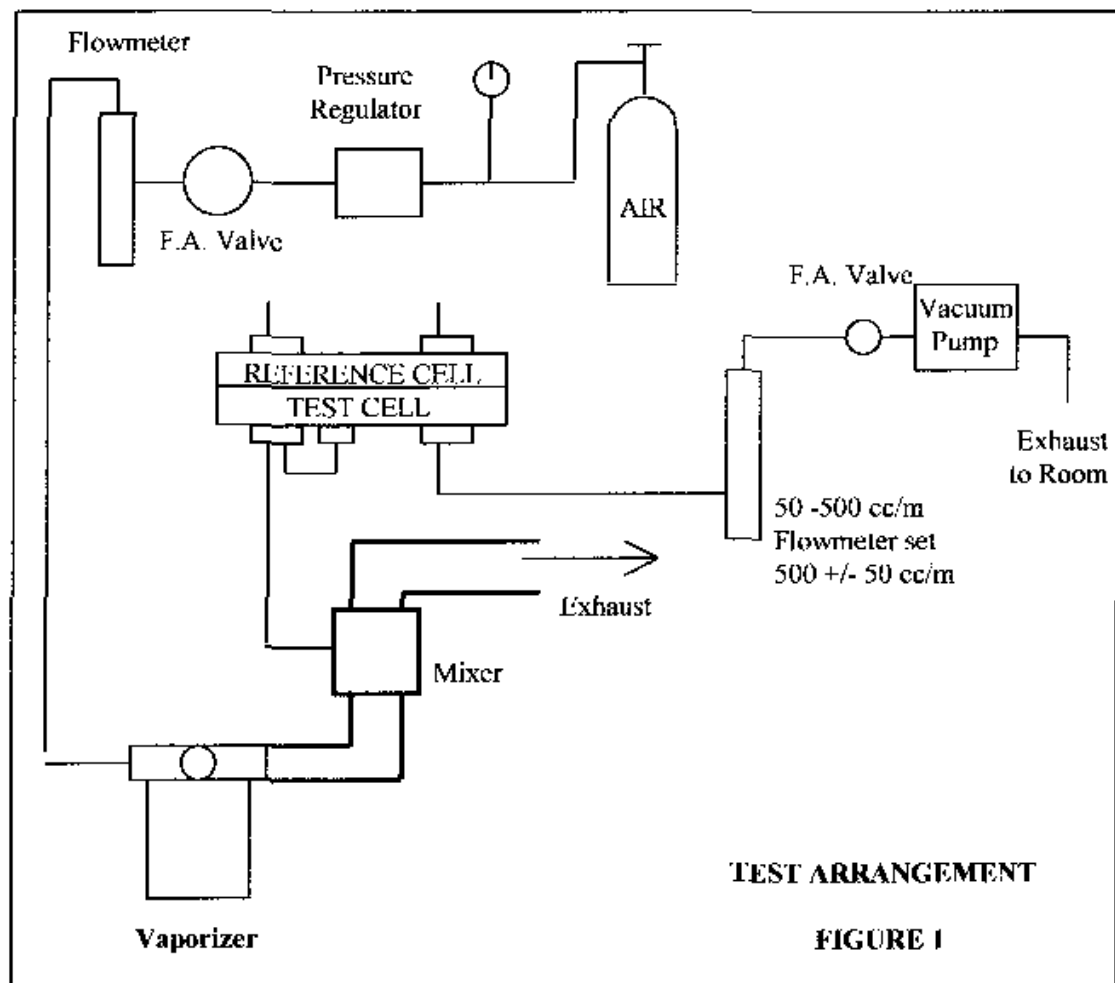
MAX TEST PROCEDURE

Connect the vaporizer into the test circuit as shown in Figure 1.

Pass a flow of 5 litres/min. Air through the circuit.

Turn the vaporizer to its maximum percentage mark. Maintain fringes lined up and after approximately 30 seconds or more note refractometer reading.

Measured percentage when establishing dryness should not exceed 0.01% anaesthetic agent. If the measured percentage is more than 0.01% the vaporizer must be subjected to a further drying out cycle - see Section 1.



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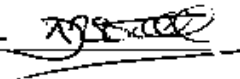
SECTION 4

CALIBRATION TESTS

REVISION:- 3

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SECTION 4

CALIBRATION TESTS

NOTE These procedures are applicable to all Tec 4 vaporizers.

The Setting Up and use of the Laser Refractometer is facilitated through a Laptop Computer which has special software installed.

SETTING UP PROCEDURE

Please refer to the Operating Instructions for R & B Instruments Precision and Portable Refractometers.

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VAPORIZER TESTING PROCEDURE

NOTE These procedures are applicable to all Tec 4 Vaporizers.

- 1 Prior to the start of testing, fill the vaporizer(s) to the 'Full' mark and leave to stand in the Testing Department for a minimum of 1 hour.**
- 2 Place a thermometer on the upper part of one of the vaporizers in the batch which is to be tested.**
- 3 Install a vaporizer on the test rig, making sure that it is properly locked in place.**
- 4 Carry out the test routine as detailed in Section 2.3 of the Operating Instructions for the Portable Refractometer and print a copy of the results/test certificate.**
- 5 Check the test results against the tolerances given for the relevant vaporizer in this section or in the appropriate Wall Chart i.e. AEQW-003 (See Section 10).**
- 6 If the vaporizer has passed all the calibration tests, mark a 'T', in black felt-tip pen, on a self adhesive label stuck to the top face of the Interlock Block and place the vaporizer on the trolley for drying-out**

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DIAL SETTINGS FOR TESTING TEC 4 VAPORIZERS

| ISOFLURANE 5% | HALOTHANE 5% | ENFLURANE 5% | ENFLURANE 7% |
|--------------------------|-------------------------|-------------------------|-------------------------|
| 0 | 0 | 0 | OFF |
| 0.5 | 0.5 | 0.2 | 0.5 |
| 1.0 | 1.0 | 0.4 | 1.0 |
| 2.0 | 2.0 | 0.6 | 2.0 |
| 3.0 | 3.0 | 1.0 | 3.0 |
| 4.0 | 4.0 | 1.5 | 4.0 |
| 5.0 | 5.0 | 2.0 | 5.0 |
| | | 3.0 | 6.0 |
| | | 4.0 | 7.0 |

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SECTION 5

CURRENT DIAL STRIPS

REVISION: 0

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AUTHORISATION:- 

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Dial Strips

A list of current Dial Strips together with their variation for each specific Vaporizer is given as follows:-

| Vaporizer Type | Max % | Dial Strip Part No. | Calibration Variation | Marked |
|----------------|-------|---------------------|-----------------------|--------|
| Halothane | 5 | 2400-0022/TA | Highest | Yes |
| | | 2400-0022/A | | Yes |
| | | 2400-0022/A2 | | Yes |
| | | 2400-0022/TB | | Yes |
| | | 2400-0022/B | | Yes |
| | | 2400-0022/B2 | | Yes |
| | | 2400-0022/TC | | Yes |
| | | 2400-0022/C | | Yes |
| | | 2400-0022/C2 | | Yes |
| | | 2400-0022/D | Lowest | Yes |
| | | 2400-0022/D2 | | Yes |
| Isoflurane | 5 | 2400-0022/TB | Highest | Yes |
| | | 2400-0022/B | | Yes |
| | | 2400-0022/B2 | | Yes |
| | | 2400-0022/TC | | Yes |
| | | 2400-0022/C | | Yes |
| | | 2400-0022/C2 | | Yes |
| | | 2400-0022/D | Lowest | Yes |
| | | 2400-0022/D2 | | Yes |
| Enflurane | 5 | 2400-0022/Y7A | Highest | Yes |
| | | 2400-0022/Y6A | | Yes |
| | | 2400-0022/Y5A | | Yes |
| | | 2400-0022/Y4A | Lowest | Yes |
| Enflurane | 7 | 2400-0022/J7 | Highest | Yes |
| | | 2400-0022/J7B | | Yes |
| | | 2400-0022/J6 | | Yes |
| | | 2400-0022/J6B | | Yes |
| | | 2400-0022/J5 | | Yes |
| | | 2400-0022/J5B | | Yes |
| | | 2400-0022/J4 | | Yes |
| | | 2400-0022/J4C | | Yes |
| | | 2400-0022/J3C | Lowest | Yes |

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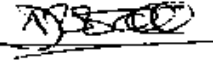
SECTION 6

TEST TOLERANCES

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Tec 4 Enfluratec 7%

Room Temperature Tolerances (22°C)

Table gives % v/v
Enflurane in air

| <u>Dial</u> | <u>Min</u> | <u>Max</u> |
|-------------|------------|------------|
| 0.50 | 0.45 | 0.55 |
| 1.00 | 0.90 | 1.10 |
| 2.00 | 1.80 | 2.20 |
| 3.00 | 2.70 | 3.30 |
| 4.00 | 3.60 | 4.40 |
| 5.00 | 4.50 | 5.50 |
| 6.00 | 5.40 | 6.60 |
| 7.00 | 6.30 | 7.70 |

Elevated Temperature Tolerances (35°C)

Table gives % v/v
Enflurane in air

| <u>Dial</u> | <u>Min</u> | <u>Max</u> |
|-------------|------------|------------|
| 0.50 | 0.45 | 0.58 |
| 1.00 | 0.90 | 1.10 |
| 2.00 | 1.80 | 2.20 |
| 3.00 | 2.70 | 3.30 |
| 4.00 | 3.60 | 4.40 |
| 5.00 | 4.50 | 5.50 |
| 6.00 | 5.40 | 6.60 |
| 7.00 | 6.30 | 7.70 |

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Tec 4 Enfluratec 5%

Room Temperature Tolerances (22°C)

Table gives % v/v
Enflurane in air

| Dial | Min | Max |
|------|------|------|
| 0.00 | 0.00 | 0.05 |
| 0.20 | 0.10 | 0.30 |
| 0.40 | 0.30 | 0.50 |
| 0.60 | 0.50 | 0.70 |
| 1.00 | 0.85 | 1.10 |
| 1.50 | 1.40 | 1.70 |
| 2.00 | 1.80 | 2.20 |
| 3.00 | 2.70 | 3.30 |
| 4.00 | 3.60 | 4.40 |
| 5.00 | 4.50 | 5.50 |

Elevated Temperature Tolerances (35°C)

Table gives % v/v
Enflurane in air

| Dial | Min | Max |
|------|------|------|
| 0.00 | 0.00 | 0.02 |
| 0.20 | 0.18 | 0.22 |
| 0.40 | 0.36 | 0.44 |
| 0.60 | 0.54 | 0.66 |
| 1.00 | 0.90 | 1.10 |
| 1.50 | 1.35 | 1.65 |
| 2.00 | 1.80 | 2.20 |
| 3.00 | 2.70 | 3.30 |
| 4.00 | 3.60 | 4.40 |
| 5.00 | 4.50 | 5.50 |

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Tec 4 Isotec 5%

Room Temperature Tolerances (22°C)

**Table gives % v/v
Isoflurane in air**

| Dial | Min | Max |
|-------------|-------------|-------------|
| 0.00 | 0.00 | 0.05 |
| 0.50 | 0.35 | 0.60 |
| 1.00 | 0.85 | 1.10 |
| 2.00 | 1.80 | 2.20 |
| 3.00 | 2.70 | 3.30 |
| 4.00 | 3.60 | 4.40 |
| 5.00 | 4.50 | 5.50 |

Elevated Temperature Tolerances (35°C)

**Table gives % v/v
Isoflurane in air**

| Dial | Min | Max |
|-------------|-------------|-------------|
| 0.00 | 0.00 | 0.05 |
| 0.50 | 0.45 | 0.55 |
| 1.00 | 0.90 | 1.10 |
| 2.00 | 1.80 | 2.20 |
| 3.00 | 2.70 | 3.30 |
| 4.00 | 3.60 | 4.40 |
| 5.00 | 4.50 | 5.50 |

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Tec 4 Fluotec 4% & 5%

Room Temperature Tolerances (22°C)

**Table gives % v/v
Fluothane in air**

| Dial | Min | Max |
|--------------|-------------|-------------|
| 0.50 | 0.35 | 0.60 |
| 1.00 | 0.85 | 1.10 |
| 2.00 | 1.80 | 2.20 |
| 3.00 | 2.70 | 3.30 |
| 4.00* | 3.60 | 4.40 |
| 5.00 | 4.50 | 5.50 |

***(Fluotec 4% maximum dial setting)**

Elevated Temperature Tolerances (35°C)

**Table gives % v/v
Fluothane in air**

| Dial | Min | Max |
|-------------|-------------|-------------|
| 0.50 | 0.45 | 0.55 |
| 1.00 | 0.90 | 1.10 |
| 2.00 | 1.80 | 2.20 |
| 3.00 | 2.70 | 3.30 |
| 4.00 | 3.60 | 4.40 |
| 5.00 | 4.50 | 5.50 |

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SECTION 7

FINAL INSPECTION

REVISION:- 2

DATE: 20.07.95

AUTHORISATION:-

A handwritten signature in black ink, appearing to be 'A. E. Services', written over a horizontal line.

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SECTION 7

Final Inspection Procedure

1. Examine test sheets ensuring all tests have been completed, and that an authoritative signature is recorded in the QA Approved box.
2. Tactile Tests:-
 - a) Operate the Lock/Unlock lever to check for free action and that the return spring is in place.
 - b) Check that the vaporizer can only be turned on when the Lock/Unlock Lever is in the 'Locked' position.
 - c) Turn Vaporizer dial fully clockwise and anti-clockwise ensuring that there is no undue resistance and that the 'stop' control functions correctly.
 - d) Turning the vaporizer on and off check visually that both interlock rods operate correctly.
 - e) Examine the Key Filler bridge to confirm that it is correct.

Where a product does not conform at a),b),c),d) or e) this shall be brought to the attention of the Service/Test Supervisor who shall decide on the appropriate course of action.

3. Thoroughly clean the vaporizer.
4. When cleaning is completed, ensure that a Serial Number Plate is fitted and record the serial number on the Test Sheet. Write the date and/or sign the Final Inspection and QA boxes of the Test Certificate and Test Record.
5. Attach self adhesive labels to the vaporizer as required.
6. Check that all labels are correct i.e vaporizer type, agent type, and that they are fitted in the correct positions.
7. Place the cleaned and labeled vaporizer in a polythene bag.

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SERVICE MANUAL

TEC 4 VAPORIZERS



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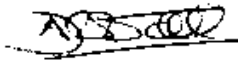
Tec 4 Vaporizer Service Manual

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TEC 4 VAPORIZER SERVICE MANUAL

AEQM - 04.1

DOCUMENT LIST

| <u>SECT</u> | <u>DESCRIPTION</u> | <u>REV</u> | <u>DATE</u> | <u>AUTHORISATION</u> |
|-------------|----------------------------|------------|-------------|---|
| 1 | Standard Service Procedure | 7 | 14.03.01 |  |
| 2 | Leak Test | 2 | 14.03.01 | |
| 3 | Max. Test | 2 | 01.05.95 | |
| 4 | Calibration Tests | 3 | 28.02.01 | |
| 5 | Current Dial Strips | 0 | 14.03.01 | |
| 6 | Test Tolerances | 0 | 14.03.01 | |
| 7 | Final Inspection | 2 | 20.07.95 | |
| 8 | Thermostat | 2 | 14.03.01 | |
| 9 | Appendices | 0 | 14.03.01 | |
| 10 | For Future Use | - | - | |

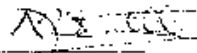
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SECTION 8

**THERMOSTAT SERVICING
AND SETTING PROCEDURE**

REVISION:- 2

DATE: 14.03.01

AUTHORISATION:- 

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Section 8

Thermostat Servicing and Setting Procedure

NOTE: Thermostats covered by this procedure will have been removed from Vaporizers due to performance failure.

- 1 Clean off residual shellac from thermostat adjusting and minimum stop screws.

NOTE: It is not necessary to remove all traces of shellac, just loose particles that may detach as thermostat screws/nuts are adjusted.

- 2 Open flapper with fingers, hold up to light source, and examine area between flapper and thermostat body for dirt or dust particles.
Whilst still holding flapper open, blow clean air, using air-line gun, through thermostat via inlet hole. RE-EXAMINE.
- 3 Segregate thermostat types i.e. 'E' Enflurane and 'F' Fluotec/Isotec
Using gauges TO1 and TO2, check the effective length as appropriate (TO1) F=24.5 mm. and (TO2) E= 28.3mm.
- 4 Note that this step is only performed if the thermostat spring hinge is suspected of being deformed, as indicated by instability on setting or very low resistance.
Remove the two Pozi HD screws securing the leaf spring and one clamp plate.
Detach the spring hinge from the flapper by removing the two c/sk Pozi HD screws. Fit new hinge to flapper and secure, ensuring hinge is square to flapper.
Position flapper assembly onto thermostat body and fit clamp plate and leaf spring, secure loosely using two Pozi pan HD screws.
Set hinge gap using tool (TO3) and secure flapper and leaf spring assembly square to the thermostat body by fully tightening the two Pozi pan HD screws.

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Thermostat Setting Procedure

Cleaning:

Before installing thermostats onto test racks, visually check between flapper and thermostat body for dirt particles, blowing through with an air-line to clear passages.

Polishing:

Using a wad of clean paper inserted between the adjusting screw and Bi-metal strip, polish the adjusting screw end by rubbing the paper wad vigorously backwards and forwards (approx. 15 times.) (Re-new paper wad frequently as it becomes dirty or worn).

Racking:

Install thermostats (of same type) onto racks ensuring 'O' rings are correctly in place (in the test racks).
Place racks aside for 24 hours to allow temperature to stabilize.
Protect from dirt particles with polythene sheets.

Setting:

Notes

Ensure that the room temperature is stable at $22^{\circ}\text{C} \pm 1^{\circ}\text{C}$ before attempting to set any thermostat. Monitor thermostat temperature using a thermometer inserted into one of the nozzles of each test rack.

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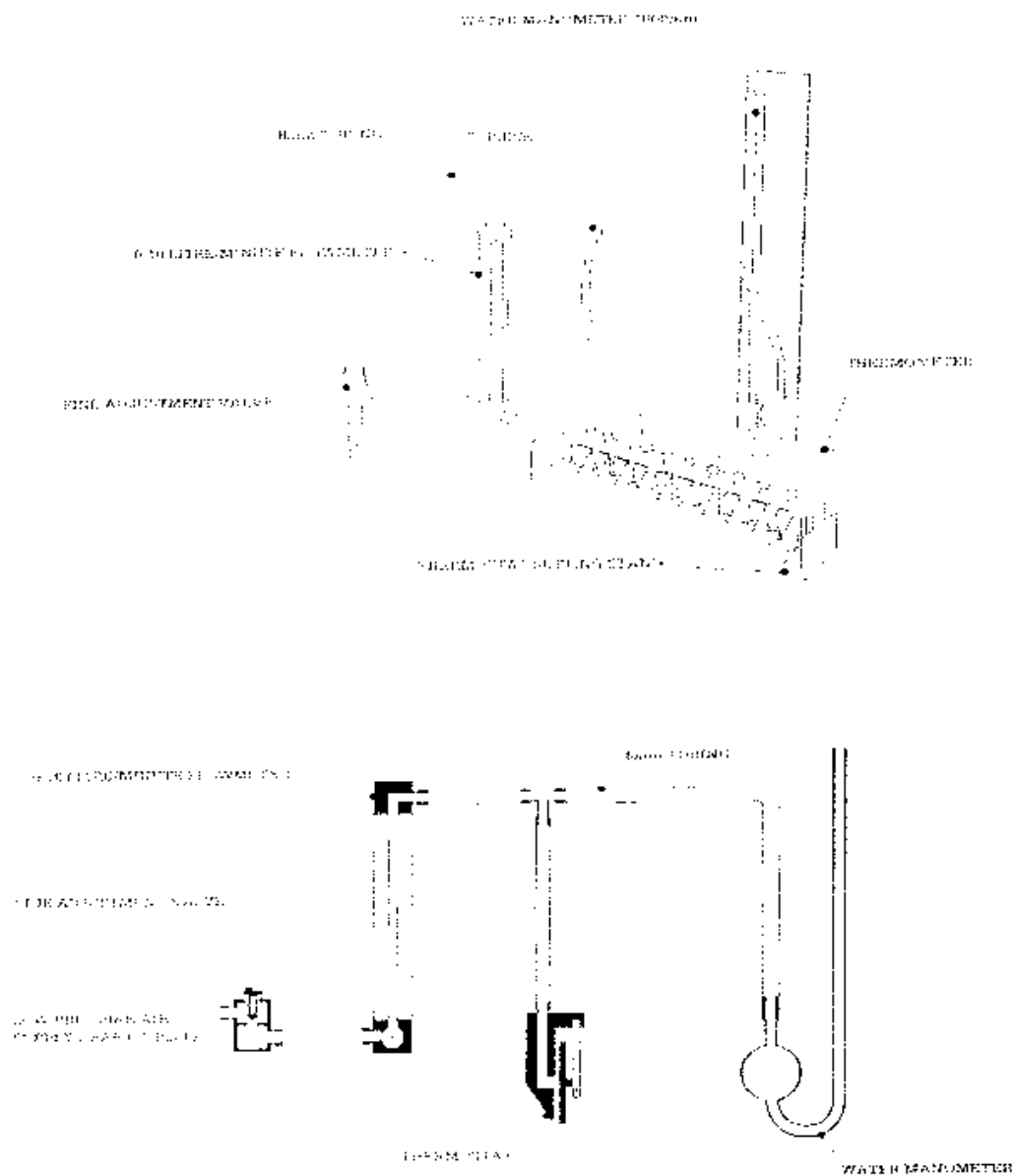


FIGURE 1 Thermostat Test Arrangement

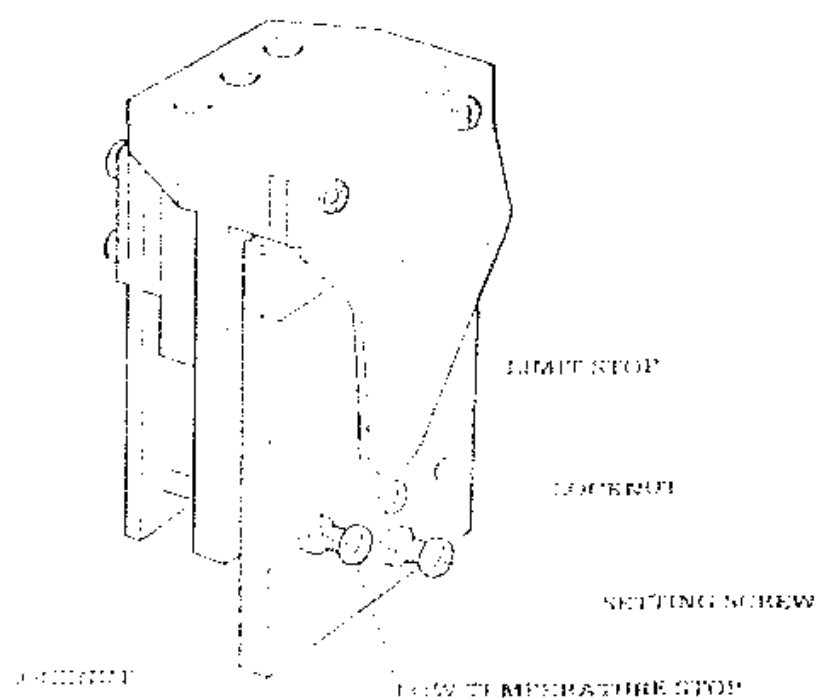


FIGURE 2 Thermostat Assembly

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Minimum Flow Stop:

- a) Adjust the air flow to 5 Litres/Min without a thermostat in circuit. Ensure that water manometer indicates zero.
- b) Back-off the adjusting screw so that it is clear of the bi-metal strip.
- c) Connect air supply to nozzle of test rack and adjust flow/temperature stop (minimum stop) so that the indicated pressure is between 38 and 44 cms water.
- d) Tighten lock-nut then re-check pressure reading.
- e) Re-adjust as necessary
- f) Record date, pressure, and temperature on AEQF-10.7.1/4.

Maximum Flow Setting:

Check the temperature indicated by the thermometer inserted in the nozzle of the test rack.

Adjust setting screw to obtain a manometer reading at a flow of 5.0 litres/min air in accordance with tolerances.

Tighten lock nut.

Record date, pressure and temperature on AEQF-10.7.1/4.

Stability:

The thermostat is a relatively delicate instrument and the stability may be impaired if the unit is roughly handled. Alternatively, thermostat instability can be caused by dirt or dust. Stability is usually restored by careful and thorough cleaning and, if necessary, re-polishing of the bearing surfaces.

- a) Maintain air flow at 5.0 Litres/Min to the thermostat.
- b) Observe pressure reading on Manometer.
- c) Using a finger, apply a moderate force against the head of the setting screw for approx. 1 sec then release finger. Check that the pressure has not altered from its original setting by more than approx. 1.0 cm water. Record date, pressure, and temperature on AEQF-10.1.1/7.
- d) Similar to (c) but instead, open flapper by pulling at head of adjusting screw and releasing after approx. 1 second. Record date, pressure, and temperature on AEQF-10.7.1/4.
- e) If the thermostat fails the 'push/pull' tests reject thermostat and segregate for rectification.

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Final Check:-

A final check on the thermostat setting shall be carried out prior to installation in the vaporizer. As follows:-

- 1) Ensure temperature is within permitted tolerance.
- 2) Set manometer to zero. Air-flow at 5 litres/min.
- 3) Pass 5 litres/min through thermostat.
- 4) Check pressure reading to tolerance chart.
- 5) Record date, pressure, and temperature on AEQF-10.7.1/4.
- 6) Apply shellac to low temperature stop and setting screws.

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| <u>Tec 4 Vaporizer</u> | <u>Filler</u> | <u>Thermostat Type</u> |
|------------------------|---------------|------------------------|
| Enflurane 5% - | Screw | Ethrane |
| Enflurane 7% - | Screw | Ethrane |
| Enflurane 5% - | Keyed | Ethrane |
| Enflurane 7% - | Keyed | Ethrane |
| Fluotec 5% - | Screw | Fluotec |
| Fluotec 4% - | Screw | Fluotec |
| Fluotec 5% - | Screw | Fluotec |
| Fluotec 5% - | Keyed | Fluotec |
| Isotec 5%- | Screw | Fluotec |
| Isotec 5% - | Keyed | Fluotec |

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TOLERANCES FOR HALOTHANE THERMOSTATS

| Temperature °C | Temperature °F | Nominal cm H ₂ O | Maximum cm H ₂ O | Minimum cm H ₂ O |
|-------------------|-------------------|--------------------------------|--------------------------------|--------------------------------|
| 18.9 | 66.0 | 30.3 | 32.7 | 28.2 |
| 19.2 | 66.5 | 29.3 | 31.5 | 27.5 |
| 19.4 | 67.0 | 28.3 | 30.3 | 26.7 |
| 19.7 | 67.5 | 27.5 | 29.3 | 26.0 |
| 20.0 | 68.0 | 26.7 | 28.3 | 25.4 |
| 20.3 | 68.5 | 26.0 | 27.5 | 24.8 |
| 20.6 | 69.0 | 25.4 | 26.7 | 24.2 |
| 20.8 | 69.5 | 24.8 | 26.0 | 23.6 |
| 21.1 | 70.0 | 24.2 | 25.4 | 23.0 |
| 21.4 | 70.5 | 23.6 | 24.8 | 22.5 |
| 21.7 | 71.0 | 23.0 | 24.2 | 22.1 |
| 21.9 | 71.5 | 22.5 | 23.6 | 21.6 |
| 22.2 | 72.0 | 22.1 | 23.0 | 21.2 |
| 22.5 | 72.5 | 21.6 | 22.5 | 20.8 |
| 22.8 | 73.0 | 21.2 | 22.1 | 20.5 |
| 23.1 | 73.5 | 20.8 | 21.6 | 20.1 |
| 23.3 | 74.0 | 20.5 | 21.2 | 19.8 |
| 23.6 | 74.5 | 20.1 | 20.8 | 19.4 |
| 23.9 | 75.0 | 19.8 | 20.5 | 19.1 |
| 24.2 | 75.5 | 19.4 | 20.1 | 18.8 |
| 24.4 | 76.0 | 19.1 | 19.8 | 18.5 |

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TOLERANCES FOR ENFLURANE THERMOSTATS

| Temperature °C | Temperature °F | Nominal cm H ₂ O | Maximum cm H ₂ O | Minimum cm H ₂ O |
|-------------------|-------------------|--------------------------------|--------------------------------|--------------------------------|
| 18.9 | 66.0 | 31.5 | 33.8 | 29.1 |
| 19.2 | 66.5 | 30.9 | 32.7 | 28.2 |
| 19.4 | 67.0 | 29.1 | 31.4 | 27.3 |
| 19.7 | 67.5 | 28.2 | 30.2 | 26.5 |
| 20.0 | 68.0 | 27.3 | 29.2 | 25.7 |
| 20.3 | 68.5 | 26.5 | 28.2 | 25.0 |
| 20.6 | 69.0 | 25.7 | 27.3 | 24.3 |
| 20.8 | 69.5 | 24.9 | 26.5 | 23.6 |
| 21.1 | 70.0 | 24.2 | 25.7 | 23.0 |
| 21.4 | 70.5 | 23.6 | 25.0 | 22.4 |
| 21.7 | 71.0 | 23.0 | 24.3 | 21.8 |
| 21.9 | 71.5 | 22.4 | 23.6 | 21.2 |
| 22.2 | 72.0 | 21.8 | 23.0 | 20.6 |
| 22.5 | 72.5 | 21.2 | 22.4 | 20.0 |
| 22.8 | 73.0 | 20.6 | 21.8 | 19.5 |
| 23.1 | 73.5 | 20.0 | 21.2 | 19.0 |
| 23.3 | 74.0 | 19.5 | 20.6 | 18.5 |
| 23.6 | 74.5 | 19.0 | 20.0 | 18.0 |
| 23.9 | 75.0 | 18.5 | 19.5 | 17.6 |
| 24.2 | 75.5 | 18.1 | 19.0 | 17.2 |
| 24.4 | 76.0 | 17.6 | 18.5 | 16.8 |

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SECTION 9

APPENDICES

REVISION:- 0

DATE:- 15.03.2001

AUTHORISATION:- _____

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